**Objectives**

Upon completion of this activity, you will be able to:

* Identify movement and/or change of matter as it moves through the water cycle.
* Define residence time and predict how a system is impacted by changes in residence time.

**Causal Principles**

1. Gravitational energy, thermal energy and/or chemical **energy** drive all movement and change of matter on Earth.
2. A system is in **equilibrium** when energy in the system is balanced.
3. Matter moves and changes to return a system to **equilibrium**.
4. **Energy** is needed to break bonds and is released when bonds form.
5. **Temperature** is a measure of the movement of molecules. Higher temperature means molecules are moving faster.

**PART 1: Class Notes**

**Part 2: Group Work**

A. On the diagram below, identify at least five reservoirs in the water cycle:

B. Label the phases or phase changes that occur at each component and between components of the water cycle.

C. Label the causal principles by their numbers where they would be appropriate in the diagram.

D. Imagine the process of condensation in Earth’s atmosphere stops. How would this affect flow of water in streams? Use the steps of the water cycle to explain your reasoning.

**Part 3: Homework – Residence Time**

Residence time is the average amount of time that a material remains in a reservoir. Residence time is calculated by the following equation:

R.T. = amount in a reservoir ÷ flow in (or out) of the reservoir.

**Homework Questions**

1. Sometimes an aquifer is pumped dry and the sediment compacts so that it can no longer hold any groundwater. How would this impact the residence time of groundwater in the water cycle?
2. Increase
3. Decrease
4. Remain the same
5. If the temperature of the atmosphere decreases, condensation will increase. What would happen to the residence time of water in the atmosphere if there were global cooling?
6. Increase
7. Decrease
8. Remain the same
9. If all the glacial ice on Earth melted, what would happen to the residence time of water in the atmosphere?
   1. Increase
   2. Decrease
   3. Remain the same
10. If the temperature of the atmosphere increases, more evaporation will occur. What would happen to the residence time of water in the atmosphere if there were global warming?
    1. Increase
    2. Decrease
    3. Remain the same